

Consistency of Version 2 Data

After Version 2 data were produced, the consistency of the new data set was examined by comparing clear-sky measurements of different years. In the first step of the analysis, the ratio $q_{V2}(\lambda) \equiv E_M(\lambda) / E_C(\lambda)$ of measured spectra $E_M(\lambda)$ and modeled spectra $E_C(\lambda)$ was calculated from all data associated with clear-sky periods. The comparison with the model is helpful to remove the dependence of known parameters such as SZA, total ozone, and albedo from the measurement, which are different every year. It also alleviates the difficulty that clear skies occur in different periods for every year. Note that model results were part of the correction procedures used to produce Version 2 data. For example, total ozone and albedo were retrieved from measured spectra and used as model input parameters. Model results are therefore not independent from the measurement. Nonetheless, a comparison of measurement and model proved to be valuable in detecting problems of the measurements.

In the second step of the analysis, medians of $q_{V2}(\lambda)$ were calculated for every year on a wavelength-by-wavelength basis using all available ratio spectra $q_{V2}(\lambda)$ with SZA smaller than 75° . The resulting median-ratio-spectra are denoted $M(\lambda, y)$ and vary between 0.95 and 1.05 for wavelengths larger than 320 nm. For the final step of the analysis, we consider the ratio $Q(\lambda, y)$, defined as:

$$Q(\lambda, y) = \frac{M(\lambda, y)}{\frac{1}{11} \sum_{y'=1994}^{2004} M(\lambda, y')}$$

The denominator of Eq. (1) is the average of all median-ratio-spectra from 1994 – 2004, which are years with background aerosol conditions. Due to the construction of $Q(\lambda, y)$, systematic differences between measurement and model, which affect all years equally such as those arising from the extraterrestrial spectrum used by the model, are ratioed out. These “Q-ratios” are shown in Figure 1 for every year. With the exception of 1990, Q-ratios of all years agree to within $\pm 5\%$ confirming that corrected measurements of all years but 1990 are consistent at the $\pm 5\%$ level and agree within the measurement uncertainty. Measurements from 1990 mark the start of operational measurements at Palmer Station. At that time, neither calibration procedures nor calibration standards were as well established as in later years of operation. In addition, the determination of the median $M(\lambda, 1990)$ is uncertain since it is based on 12 ratio-spectra only due to the lack of sufficient clear sky data.

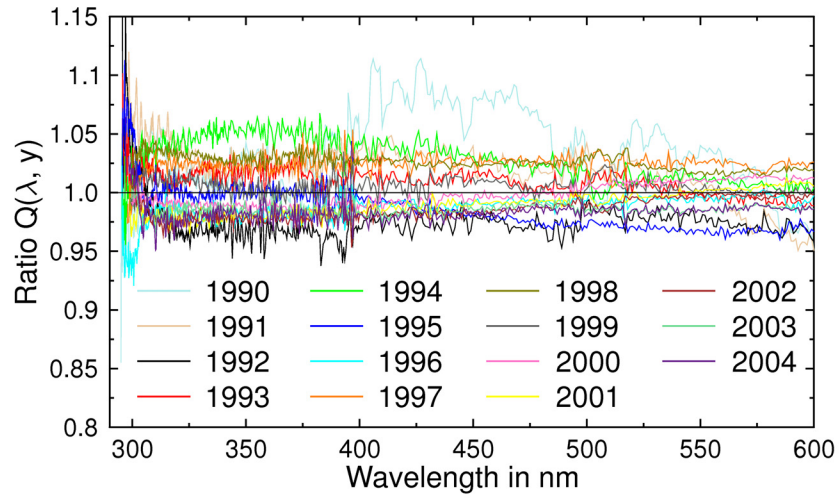


Figure 1. Normalized Q-ratios of measurement and model for the years 1990 – 2004 at Palmer Station.